



# PARTICIPANT HANDBOOK



Food & Beverage

Language:  
English

# Fruits and Vegetable Processing



N · S · D · C  
National  
Skill Development  
Corporation

Transforming the skill landscape



Funded Partner of NSDC

# **FRUITS AND VEGETABLES PROCESSING**

**फल और सब्जी प्रसंस्करण**



Orion House, 28, Chinar Park, Rajarhat Road  
Kolkata – 700157, Ph.: +91 33 40051635

[www.orionedutech.com](http://www.orionedutech.com)

## Welcome Note

Dear Participant,

Welcome to the "Fruits and vegetable processing" training programme. After completion of the training, Participants would be able to:

- ✓ Develop proficiency in producing different processed fruits & vegetables
- ✓ Operate & maintain modern Equipment & machinery
- ✓ Make different processed food products with quality assurance.
- ✓ Conduct the process of Packaging, Storing & marketing

Read each module, log your key learning and attempt the worksheet questions in the end.

## **General Instructions to Trainee**

- 1.** Greet your instructor and the other participants when you enter the class.
- 2.** Always be punctual for every class.
- 3.** Be regular. Candidates who fall short of the required attendance will not be certified.
- 4.** Inform your instructor if, for any reason, you need to miss class.
- 5.** Pay attention to what your instructor is saying or showing.
- 6.** If you do not understand something, put up your hand and seek clarification.
- 7.** Make sure you do all the exercises at the end of each module in this book. It will help you understand the concepts better.
- 8.** Practice any new skills you have learnt as many times as possible. Seek the help of your Trainer or co-participant for practice.
- 9.** Take all necessary precautions, as instructed by your Trainer, while working with electricity and with tools.
- 10.** Make sure you are neatly attired and presentable at all times.
- 11.** Participate actively in all the activities, discussions and games during training.
- 12.** Always take bath, wear clean clothes and comb your hair before you come to class.

The three most important words you must always remember and use in your daily conversation are PLEASE, THANK YOU and SORRY.

# TABLE OF CONTENTS

## (FRUITS AND VEGETABLES PROCESSING)

### Introduction

---

Importance of fruits and vegetables in daily life  
Nutrients in fruits and vegetables  
Prevention of Disease  
Weight Management

### Chapter - 1

---

#### **Preservation Technology**

1.1 Preservation of Fruits and Vegetables  
1.2 When to Pick

### Chapter - 2

---

#### **Technical Terms Used in Preservation Industry**

### Chapter - 3

---

#### **Classifications of Fruits and Vegetables**

3.1 Classification of Fruits on the Basis of pH  
3.2 Foods: Are They Acid or Alkaline-forming?  
3.3 Food Preservation Methods

### Chapter - 4

---

#### **Canning of Fruits and Vegetables**

4.1 Canning of fruits  
4.2 Pre-treatment of foods before canning

### Chapter - 5

---

#### **Drying / Dehydration**

5.1 Dehydration of Fruits and Vegetables  
5.2 Drying Fruits and Vegetables

### Chapter - 6

---

#### **Making of Jam and Jelly**

6.1 Process of making jams  
6.2 Test of pectin  
6.3 Indian Food Standard: - FSSAI

### Chapter - 7

---

#### **Pickles**

7.1 What is a pickle?  
7.2 Types of fruits and vegetables which can be pickled  
7.3 Types of pickles  
7.4 Machines used for pickle making



## Chapter - 8

---

### **Making of Tomato Ketchup, Chutney, Sauce and Vinegar**

8.1 Making of tomato ketchup

8.2 Process of making tomato ketchup

8.3 Types of chutneys

8.4 Potato chips manufacturing

8.5 Vinegar Making Process

## Chapter - 9

---

### **Safety Precautions for Fruits and Vegetable Industry**

9.1 From Purchase to Preparation

9.2 Precautions for fruits and vegetables industry

9.3 Preparing Products from Waste

9.4 Identify and sell more to customers

## Chapter - 10

---

### **CRM**

10.1 Maintaining reliable and fast information helpful for customer and the Organisation

10.2 Understanding different types of customers and dealing differently





## INTRODUCTION



### Importance of fruits and vegetables in daily life



Fruits and vegetables provide health benefits and are important for the prevention of illnesses. Fruits and vegetables contain a variety of nutrients including vitamins, minerals and antioxidants. Eating the recommended amount of fruits and vegetables each day can reduce the risk of chronic diseases.

### Nutrients in fruits and vegetables



wound healing and keeps gums and teeth healthy.

- Fruit is naturally low in fat, sodium and calories, and rich in potassium, fibre, vitamin C and folate.
- Some high-potassium fruits include peaches, cantaloupe, honeydew, oranges and bananas.
- Fibre in fruit helps to protect against heart disease and lower cholesterol.
- Vitamin C in foods like citrus and strawberries helps with

### Prevention of Disease

- Eating produce can cut your risk of cardiovascular disease, stroke and type 2 diabetes and protect against various forms of cancer.
- The fruits and vegetables high in fibre can reduce chances of developing coronary heart disease.
- Eating potassium-rich foods such as bananas and potatoes can help reduce blood pressure, decrease bone loss and prevent development of kidney stones.
- Produce also contains different phytochemicals, natural chemical compounds in plants, which maintain proper cell health.



### Weight Management

- Along with health benefits, eating fruits and vegetables can make weight management easier, according to the Centers for Disease Control and Prevention.
- Most produce is low in calories compared to other foods, so filling up on these foods can aid in weight loss or maintenance.
- Fruits and vegetables work as excellent substitutes in different recipes. For example, fresh applesauce can be used instead of oil in muffins or cookies.
- Sautéed vegetables can be added to an omelette to make it more filling without a lot of calories.



## CHAPTER - 1

# PRESERVATION TECHNOLOGY

### LEARNING OUTCOMES:



- Knowing about the fruits and vegetables industry in India
- Learning about the preservation process

### PRE-SESSION ACTIVITY

- The Trainer will show a video on preservation in fruits and vegetable industry.

#### 1.1 Preservation of fruits and vegetables



To make food available throughout the year, humans have developed methods to extend the storage life of products to preserve them. The rotting process can be postponed by

- Adding preservatives,
- Optimizing storage conditions, or
- Applying modern techniques

Most fruits and vegetables are edible for a very short time as they are seasonal, unless they are promptly and properly preserved. Insects can cause a lot of damage, not only by eating the products, but also by passing on microorganisms.

Chemical and enzyme spoilage occurs especially when vegetables and fruit are damaged by falling or breaking. Such damage can release enzymes and chemical reactions takes place. For example Tomatoes become soft and apples and other types of fruit turn brown. Enzymes can be deactivated by heating the fruit or vegetables. The same effect can be achieved by making the fruit or vegetables sour or by drying them, but the enzymes become active again as soon as the acidity is reduced or water is added.

## Fruits and Vegetables Processing

Water is necessary for causing many physical processes. Microorganisms grow in the presence of dampness and water. Drying is therefore one method of preventing spoilage. Meat and fish do not have to be 100% dry in order to preserve them. By adding salt, the remaining water becomes unsuitable for micro-organisms. The same effect can be achieved by adding sugar to fruit.

Just like humans, microorganisms also need nutrients: sugars, proteins, fats, minerals and vitamins. These are rarely in short supply, because they can be found in all food products.

To flourish, microorganisms need a temperature of between 5 and 65°C. At temperatures above 65°C, it becomes very difficult for them to survive; and they definitely die if boiled, as long as they are boiled for a certain length of time, such as 10 minutes.

### Useful storage life of some food products

Food Products	Generalized Storage Life (Days) at 21°C (70°F)
Animal Flesh, Fish, Poultry	1-2
Dried, salted, smoked meat and fish	360 and more
Fruits	1-7
Dried Fruits	360 and more
Leafy Vegetables	1-2
Root Crops	7-20

### 1.1.1 Fruit Preservation



There is a distinction between maturity and ripeness of a fruit.

- Maturity is the condition when the fruit is ready to eat or if picked will become ready to eat after further ripening.
- Ripeness is that optimum condition when colour, flavour and texture have developed to their peak.

Some fruit is picked when it is mature but not ripe. This is especially true of very soft fruit like cherries and peaches, which when fully ripe are so soft that while picking it is destroyed. Further, since many types of fruit continue to ripen off the tree, unless they were to be processed quickly, some would become overripe before they could be utilized if picked at peak ripeness.

From a technological point of view, fruit characterization by species and varieties is performed based on physical as well chemical properties: shape, size, texture, flavour, colour/pigmentation, dry matter content (soluble solids content), pectin substances, acidity, vitamins, etc. These properties are directly correlated with fruit utilization.

## 1.2 When to Pick



The proper time to pick fruit depends upon several factors; these include variety, location, weather, ease of removal from the tree (which change with time), and purpose to which the fruit will be put.

For example, oranges change with respect to both sugar and acid as they ripen on the tree; sugar increases and acid decreases. The ratio of sugar to acid determines the taste and acceptability of the fruit and the juice. For this reasons, in some countries there are laws that prohibit picking until a certain sugar-acid ratio has been reached.

### 1.2.1 Quality measurements



Many quality measurements can be made before a fruit crop is picked in order to determine if proper maturity or degree of ripeness has developed.

## Fruits and Vegetables Processing

- Colour may be measured with instruments or by comparing the colour of fruit on the tree with standard picture charts.
- Texture may be measured by compression, by hand or by simple type of plungers.

As fruit matures on the tree its concentration of juice solids, which are mostly sugars, changes. The concentration of soluble solids in the juice can be estimated with a refractometer or a hydrometer. The refractometer measures the ability of a solution to bend or refract a light beam, which is proportional to the solution's concentration. A hydrometer is a weighted spindle with a graduated neck, which floats in the juice at a height related to the juice density.

The acid content of fruit changes with maturity and affects flavour. Acid concentration can be measured by a simple chemical titration on the fruit juice. However, for many fruits the tartness and flavour are fully affected by the ratio of sugar to acid.

Percentage of soluble solids, which are largely sugars, is generally expressed in degrees Brix, which relates specific gravity of a solution to an equivalent concentration of pure sucrose.

In describing the taste of tartness of several fruits and fruit juices, the term "sugar to acid ratio" or "Brix to acid ratio" are commonly used. The higher the Brix the greater the sugar concentration in the juice; the higher the "Brix to acid ratio" the sweeter and less tart is the juice.

### 1.2.2 Harvesting and pre-processing



#### Harvesting

The above measurements, and experience, indicate when fruit is ready for harvesting and subsequent processing.

A large amount of the harvesting of most fruit crops is still done by hand; this labour may represent about half of the cost of growing the fruit. Therefore, mechanical harvesting is currently one of the most active fields of research for the agricultural engineer, but also requires geneticists to breed fruit of nearly equal size, that matures uniformly and that is resistant to mechanical damage.

A correct manual harvesting includes some rules:

- the fruit should be picked by hand and placed carefully in the harvesting basket; all future handling has to be performed carefully in order to avoid any mechanical damage;
- the harvesting basket and the hands of the harvester should be clean;
- The fruit should be picked when it is ready to be able to be processed into a quality product depending on the treatment, which it will undergo.

## Fruits and Vegetables Processing

---

The processing centre to the source of supply for fresh raw materials presents major advantages; some are as follows:

- Possibility to pick, at the best suitable moment;
- Reduction of losses by handling/transportation;
- Minimizes raw material transport costs;
- Possibility to use simpler/cheaper receptacles for raw material transport

Once it has left the tree, the nutritional value, safety and aesthetic appeal of the fruit deteriorates in varying degrees. The major causes of deterioration include the following:

- a) growth and activity of micro-organisms;
- b) activities of the natural food enzymes;
- c) insects, parasites and rodents;
- d) temperature, both heat and cold;
- e) moisture and dryness;
- f) air and in particular oxygen;
- g) light and
- h) time

### 1.2.3 Reception - Quality and Quantity



Fruit reception at the processing centre is conducted mainly for following purposes:

- checking of sanitary and freshness status;
- control of varieties and fruit wholeness;
- evaluation of maturity degree;
- collection of data about quantities received, in connection to the source of supply: outside growers/farmers, own farm.



## Fruits and Vegetables Processing

Variety control is required in order to identify that the fruit belongs to an accepted variety, as not all are suitable for different technological processes.

Fruit maturity degree is significant as industrial maturity is required for some processing/preservation methods while for others there is the need for an edible maturity when the fruit has full taste and flavour.

Special attention is given to size, appearance and uniformity of fruit to be processed, mainly in the form of fruit preserved with sugar using whole/half fruits ("with fruit pieces").

Some laboratory control is also needed, even if it not easy to precisely establish the technological qualities of fruit because of the absence of enough reliable rapid analytical methods able to show eventual deterioration.

The only reliable method for evaluating the quality is the combination of data obtained through organoleptic/taste controls and by simple analytical checks, which are possible to perform in a small laboratory: percentage of soluble solids by refractometer, consistency/texture measured with simple penetrometers, etc.

### 1.2.4 Temporary storage before processing



This step has to be as short as possible in order to avoid flavour losses, texture modification, weight losses and other deterioration that can take place over this period.

Some basic rules for this step are as follows:

- keep products in the shade, without any possible direct contact with sunlight;
- avoid dust as much as possible;
- avoid excessive heat;
- avoid any possible contamination;
- Store in a place protected from possible attack by rodents, insects, etc.

Cold storage is always highly preferred to ambient temperature. For this reason a very good manufacturing practice is to use a cool room for each processing centre; this is very useful for small and medium processing units as well.

### POST-SESSION ACTIVITY

- The Trainer will conduct a video session on how to preserve fruits and vegetables.

### Debriefing of the chapter

- Most fruits and vegetables are edible for a very short time as they are seasonal, unless they are promptly and properly preserved.
- Maturity is the condition when the fruit is ready to eat or if picked will become ready to eat after further ripening.
- Colour may be measured with instruments or by comparing the colour of fruit on the tree with standard picture charts.
- In describing the taste of tartness of several fruits and fruit juices, the term "sugar to acid ratio" or "Brix to acid ratio" are commonly used.
- The fruit should be picked by hand and placed carefully in the harvesting basket; all future handling has to be performed carefully in order to avoid any mechanical damage
- Special attention is given to size, appearance and uniformity of fruit to be processed, mainly in the form of fruit preserved with sugar using whole/half fruits ("with fruit pieces").
- Keep products in the shade, without any possible direct contact with sunlight







**Test yourself**

**A. Fill in the blanks:**

1. \_\_\_\_\_ water is necessary for maintaining many physical processes.
2. \_\_\_\_\_ is that optimum condition when colour, flavour and texture have developed to their peak.
3. \_\_\_\_\_ is always highly preferred to ambient temperature.

**B. True / False:**

- |   |     |
|---|-----|
| 1. Insects can cause a lot of damage to fruits and vegetables   | T/F |
| 2. Micro-organisms need a temperature of between 5 and 65°C.  | T/F |
| 3. Chemical and enzyme spoilage occurs especially when vegetables and fruit are damaged by falling or breaking. | T/F |

## CHAPTER - 2

# TECHNICAL TERMS USED IN PRESERVATION INDUSTRY

### LEARNING OUTCOMES:



- Learning about the different terminologies of the fruit and vegetable preservation industry

### PRE-SESSION ACTIVITY

- **Industry visit:** The Trainer will take the Trainees to a fruits and vegetables preservation industry.

**Absorption:** Retention of oil or fat by a food product, which has been fried. A certain amount of fat is desirable to provide flavour, eating quality, etc. to the food. However, excessive absorption imparts an unpleasant greasiness, masks natural food flavour and is costly.

**Acceptable Daily Intake (ADI):** Quantity of a food additive that can be ingested daily, over a lifetime, without any risk (expressed in milligrams additive per kilogram body weight).

**Acesulfame K:** Acesulfame K, or acesulfame potassium, is a low-calorie sweetener. It is an organic salt consisting of carbon, nitrogen, oxygen, hydrogen, sulphur and potassium atoms. It is 200 times sweeter than sucrose, has a synergistic sweetening effect with other sweeteners, has a stable shelf-life and is heat stable. It is excreted through the human digestive system unchanged, and is therefore non-caloric.

**Acid:** Substance with a pH of less than 7.0.

**Acidified food:** Product with a natural pH of 4.6 or below.

**Acidity regulators:** Used to alter and control the acidity or alkalinity levels for different desired effects, which can include preservation, added/altered tartness, colour retention and to assist raising agents.

**Activation energy constant, E:** Temperature coefficient determined from the slope of a  $\ln(k)$  versus  $1/TA$  plot.

**Activation volume constant, V:** Pressure coefficient obtained from the slope of the  $\ln(k)$  versus a pressure difference (P-PR) plot.

**Active packaging:** Contains active component allowing a controlled interaction between the food, package and internal gaseous environment, thus extends shelf life, improves fruit and vegetable safety or provides superior sensory quality.

**Additives:** Natural and man-made substances added to a food for an intended purpose (such as preservatives and colours) or unintentionally (such as pesticides and lubricants).

**Adiabatic compression:** Compression or decompression processes occurring without heat transfer.

**Adulteration:** Deliberate contamination of foods with materials of low quality.

**Aerobe:** Organism, especially a Gram E bacterium, that requires oxygen to live.

**Aerobic plate count:** Method for determining the presence and concentration of aerobic bacteria in food products.

**Aerobic:** Requires oxygen.

**Aflatoxins:** Dangerous poisons produced by moulds of the *Aspergillus* species, found in cereals, oilseeds and nuts when incorrectly dried and stored.

**Aftertaste:** Taste and sensations that linger after food or drink has been swallowed.

**Airlock (fermentation lock):** Device that attaches to the top of a fermentation barrel or carboy that allows CO<sub>2</sub> to escape out of an airtight connection but prevents bacteria from entering.

**Alcohol:** Family name of a group of organic chemical compounds that includes methanol, ethanol, isopropyl alcohol, and others. Ethanol is produced from crops or residues with a high carbohydrate content. Alcoholic beverages contain ethanol.

**Algin:** Compound, which is extracted from algae and used in puddings, milk shakes and ice cream to make these foods creamier and thicker and to extend shelf life.

**Alkaline:** Substance that has a pH of more than 7.0.

**Aliquot:** A measured sub-volume of sample.

**Allergen:** Part of a food (a protein) that stimulates the immune system of food allergic individuals. A single food can contain multiple food allergens. Carbohydrates or fats are not allergens. Most common food allergens are nuts (especially peanuts), egg, milk, histamine, etc.

**Ally methyl trisulfide, dithiolthiones:** Type of sulfide/thiol found in cruciferous vegetables, which provide the health benefits of lowering LDL cholesterol and of maintaining a healthy immune system.

**Alpha-carotene:** Type of carotenoid found in carrots which provides the health benefit of neutralizing free radicals that may cause damage to cells.

**Alpha-tocopherol:** Chemical name for the vitamin E form with the highest biological activity. Several other tocopherols and tocotrienols also have vitamin E activity.

**Ambient temperature:** Temperature of the immediately surrounding environment. Ambient room temperature ranges from 19-23°C (68 to 77°F).

**Amino acids:** Small, nitrogen-containing molecules that are linked together to form proteins. Amino acids play central roles both as building blocks of proteins and as intermediates in metabolism.

**Anaerobe:** Organism, especially a bacterium that does not require oxygen or free oxygen to live.

**Anaerobic:** Does not require oxygen.

**Animal fat or oil:** Any naturally occurring or refined and processed fat from any animal. Animal fats may be edible or inedible depending upon source or type of processing. Examples of animal fats and oils includes refined, hydrogenated lard and edible tallow from cattle.

**Antemortem:** Before slaughter. As used in the meat and poultry inspection program, the term refers to the examination that meat inspectors are required to conduct of all live animals just before they are killed.

**Anthocyanidins:** Type of flavonoid found in various fruits, which provides the health benefits of neutralizing free radicals and possibly reducing the risk of cancer.

**Antibiotic:** Substance produced by bacteria or fungi that destroys or prevents the growth of other bacteria and fungi. Antibiotics are not effective against viruses.

**Antibody:** Protein produced by the immune system of humans and higher animals in response to the presence of a specific antigen.

**Anticaking agent:** Used to ensure the free flow in products such as dried milks, icing sugar and table salt.

**Antifoaming agent:** Important to prevent foam and bubbles during the cooking and concentrating process.

**Antigen:** Foreign substance (almost always a protein) that, when introduced into the body, stimulates an immune response.

**Antioxidant:** Chemical approved for the control of oxidation (rancidity) in food products. Approved antioxidants include: BHT, BHA, propyl-gallate. Regulations limit concentration to 0.003% for individual chemicals, 0.006% for combinations.

**Apple pomace:** Remains after pressing apples for juice extraction; raw material for the production of apple pectin.

**Aroma:** Odour detected.

**Artificial sweeteners:** Designed by man, and usually prepared by a chemical process. They are designed to supply sweetness on its own, i.e., without the carbohydrate food values which are associated with sugar. They are used by consumers who may believe it disadvantageous to use sugars for sweetening foods and drinks.

**Ascorbic acid (or ascorbate):** Chemical name for vitamin C. Lemon juice contains large quantities of ascorbic acid and is commonly used to prevent browning of peeled, light-coloured fruits and vegetables. Green peppers, broccoli, citrus fruits, tomatoes, strawberries, and other fresh fruits and vegetables are good sources of vitamin C.

**Aseptic packaging:** System wherein the food product and the container are sterilised separately, and the containers are filled and sealed in a sterile environment.

**Aseptic:** Without contamination by micro-organisms, i.e. sterile.

**Aspartame:** Aspartame is a low-calorie sweetener used in a variety of foods and beverages and as a table top sweetener. It is about 200 times sweeter than sugar. Aspartame is made by joining two protein components, aspartic acid and phenylalanine.

**Assembly-serve foodservice system:** Food service system in which food is purchased at the middle to complete end of the food processing continuum, stored either frozen or chilled, portioned, and heated before serving to customers.

**Audit:** Systematic and functionally independent examination to determine whether activities and related results comply with planned objectives.

**Automated:** System where machines handle and control the processing from raw materials to the finished product.

**Average weight:** Known proportion of containers have a fill-weight above system that shown on the label.

**Bacteria:** Large group of single-celled microorganisms, which can be both harmful and helpful to food.

**Bacteriocin:** Small, naturally occurring protein produced by one species of bacterium that effectively protects it from competing organisms. Different bacteria produce different bacteriocins.

**Bacteriophage:** Bacterial virus; a virus capable of infecting bacteria.

**Baking chocolate:** Cooled, hardened chocolate liquor. It is used primarily as an ingredient in recipes, or as a garnish.

**Balance:** The relation of malt to hops in a beer. Ideally they are balanced.

**Balling hydrometer scale:** A hydrometer scale calibrated so that readings at a specified temperature (usually 20°C) equal the percentage by weight of sugar in the solution. It is numerically equivalent to the Brix scale, but is chiefly used by brewers, whereas the Brix scale is used by sugar refineries and vintners. Devised by C J N Balling.

**Base:** Substance with a pH above 7.0. Substances with a base pH include soap (pH 10.0) and ammonia (pH 11.2).

**Base kitchen:** Kitchen in which foods are prepared, served at that location, and transported to other locations or satellites for service. Also known as a regional kitchen.

**Batch treatment:** Treatment of a static mass of food in bulk or packaged.

**Beta-carotene:** Orange-coloured plant pigment that can be converted into vitamin A in the human body. Beta-carotene is found in deep-yellow and leafy dark-green vegetables.

**Beta-glucan:** Soluble fibre in oats, which provide the health benefit of reducing the risk of cardiovascular disease by decreasing circulating blood cholesterol.

**Bi-metallic thermometer:** Food thermometer used to measure product temperatures. Uses a spring mechanism to determine temperature.



**Biological hazard:** Danger posed to food safety by the contamination of food with pathogenic microorganisms or naturally occurring toxins.

**Biological indicator system:** System (bacteria or enzyme) used to determine whether a process cycle has met the specified requirements.

**Biotechnology:** Use of living organisms or parts of living organisms, to create new products.

**Biotin:** One of the B vitamins.

**Bitter:** Flavour characteristic of food or beverages.

**Bitters:** The highly saline liquor, which remains after most of the salt, has crystallised from brine.

**Blancher:** Lidded pot designed with a fitted perforated basket to hold food in boiling water, or with a fitted rack to steam foods. Useful for loosening skins on fruits to be peeled, or for heating foods to be hot packed.

**Blanching:** Process of immersing in hot water or heating in steam at 95°C for 1-5 minutes to reduce enzyme activity.

**Blast chiller:** Refrigeration unit that chills foods from 60° to 3°C in 90-120 minutes or less.

**Bleaching:** Treatment to reduce natural pigments (carotenoids, chlorophylls and xanthophylls) and other impurities such as cations of iron, copper and zinc.

**Bleaching agents:** Used to artificially whiten flour.

**Boiling point elevation:** One of the colligative properties. The boiling point of a solution is increased over that of water by the presence of solutes, and the extent of the increase is a function of both concentration and molecular weight.

**Boiling-water canner:** Large standard-sized lidded kettle with jar rack, designed for heat-processing 7 quarts or 8 to 9 pints in boiling water.

**Botulism:** Acute food poisoning caused by eating toxin produced by growth Clostridium Botulinum bacteria in moist, low-acid food, containing less than 2% oxygen and stored between 40 degrees and 120 degrees Fahrenheit. Proper heat processing destroys this bacterium in canned food. Freezer temperatures inhibit its growth in frozen food. Low moisture controls its growth in dried food. High oxygen controls its growth in fresh foods.

**Breakdown:** General term for describing the onset or progress of undesirable chemical or physical changes in a fat or oil. Thus, breakdown of frying fats may include darkening, formation of excess free fatty acids or peroxides, polymerization and gumming and undesirable foaming.

**Brine:** The liquid, which contains high concentrations of salt.

**Brix hydrometer scale:** Sugar content of a solution at a given temperature. Named for AFW Brix, a nineteenth-century German inventor. The Brix (sugar content) is determined by a HYDROMETER, which indicates a liquid's SPECIFIC GRAVITY (the density of a liquid in relation to that of pure water). Each degree Brix is equivalent to 1 gram of sugar per 100 grams of liquid. Also known as the Plato scale.

**Buffer:** Mixture containing both a weak acid and a weak base capable of absorbing additions of either strong acid or strong base with little corresponding change in pH. Buffers are used for calibrating pH meters.

**Buffering salts:** Buffering salts are applied to lower the gelling temperature and, in the case of low-methoxyl pectins, to delay the reaction with calcium. Thus, buffering salts are also called retarding agents.

**Bulk:** Method of transporting food in large quantities, requiring that portioning be done at the receiving kitchen. Bulk food may be transported either hot or cold.

**Bulk fermentation:** Whole of the dough is fermented at 27°C in a closed container to prevent surface drying.

**Bulking agents:** Used to increase volume without significantly adding to the energy levels of the food. Normally used in diet foods but can also be used to pad out expensive ingredients. Not usually digested and acts as a source of dietary fibre (roughage).

**Butylated hydroxyanisole (BHA):** Phenolic chemical compound used to preserve foods by preventing rancidity. It may also be used as a defoaming agent for yeast. BHA is found in foods high in fats and oils; also in meats, cereals, baked goods, beer, and snack foods.

**Butylated hydroxytoluene (BHT):** Phenolic chemical compound used to keep food from changing flavour, odour and/or colour. It is added to foods high in fats and oils and cereals.